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[US/US]; 8705 Cromwell Drive, Springfield, VA 22151

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(US).

13th Street N.W., Washington, DC 20004 (US).

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US

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Filed on

30 December 1999 (30.12.1999)

- (71) Applicant (for all designated States except US): WORK SMART ENERGY ENTERPRISES, INC. [US/US]; 2948 Macomb Street, N.W., Washington, DC 20008 (US).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): KOPKO, William, L.

(74) Agents: DELUCA, Vincent, M. et al.; Rothwell, Figg, Ernst & Manbeck, Suite 701 East, Columbia Square, 555

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS,

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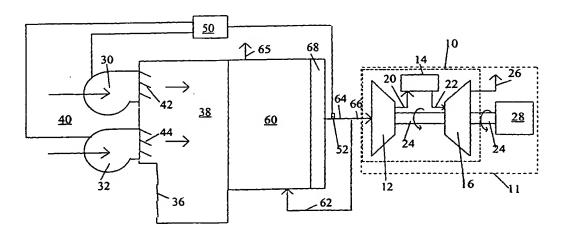
CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

- With international search report.
- Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SUPERCHARGING SYSTEM FOR GAS TURBINES



(57) Abstract: A supercharging system for gas turbine power plants (11). The system includes a supercharging fan (30, 32) and a controller (50) for limiting turbine power output to prevent overload of the generator (28) at lower ambient temperatures. The controller can limit power output by burner control, inlet temperature control, control of supercharging fan pressure and other options. The system can be retrofit on an existing turbine without replacing the generator and associated parts.

10)009195

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPO

REC'D ORT	27	AUG	2001
WIPC	<u> </u>		PCT
VVIE			

(PCT Article 36 and Rule 70)

pplicant's or agent's file reference FOR FURTHER ACTION See Notification of Transmittal of Internation Preliminary Examination Report (For PCT/IPEA/416)			ry Examination Report (Form
International application No. International filing d		day/month/year)	Priority date (day/month/year)
PCT/US00/15821	09 JUNE 2000		10 JUNE 1999
International Patent Classification (IPC) IPC(7): F02C 01/00, 09/00; E03B 7/1	or national classification at 0 and US Cl.: 60/59.05,	nd IPC 728; 138/39	RECEIVED
Applicant WORK SMART ENERGY ENTERP	RISES, INC.		J⊎N ₁ 7 2003
			JECHNOLOGY CENTER R3700
 This international prelimin Examining Authority and is This REPORT consists of a 	transmitted to the application	has been prepar cant according to	red by this International Preliminary Article 36.
This report is also accompose amended and are th	panied by ANNEXES, i.e.	or sheets containin	cription, claims and/or drawings which have ng rectifications made before this Authority.
These annexes consist of a to	tal of 0 sheets.		-
3. This report contains indication	es relating to the following	ng items:	
		B	
I X Basis of the report			
II Priority			
III Non-establishment of report with regard to novelty, inventive step or industrial applicability			
IV Lack of unity of invention			
V X Reasoned statemen citations and expla	t under Article 35(2) with nations supporting such st	regard to novelty atement	, inventive step or industrial applicability;
VI Certain documents	cited		
· <u>–</u>	he international applicatio	nn	
VIII Certain observation	s on the international app	лсанон	
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		·	
			Cali
Date of submission of the demand		Date of completio	n of this report
os January 2001		06 JULY 200	1
Name and mailing address of the IPEA	/US	Authorized officer	la Day
Commissioner of Patents and Traden Box PCT	narks	CHARLES F	REAY DOC
Washington, D.C. 20231 Facsimile No. (703) 305-3230		Telephone No.	(703) 308-0639
i racsimile ivo. (703) 303*3230			1,

International application No.

PCT/US00/15821

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step r industrial applicability; citations and explanations supporting such statement

1. statement

Novelty (N)	Claims Claims	(Please See supplemental sheet) (Please See supplemental sheet)	YES NO
Inventive Step (IS)	Claims Claims	(Please See supplemental sheet) (Please See supplemental sheet)	YES NO
Industrial Applicability (IA)	Claims Claims	(Please See supplemental sheet) (Please See supplemental sheet)	YES NO

2. citations and explanations (Rule 70.7)

Claims 77-80 lack novelty under PCT Article 33(2) as being anticipated by KOLP et al.

Kolp et al discloses a gas turbine power plant (see Fig. 12) having a gas turbine driving a generator and having first and second foggers located upstream of the gas turbine.

Claims 76, 77 and 79 are novelty under PCT Article 33(2) as being anticipated by Munk.

Munk discloses a gas turbine power plant (110, 120, 150) having a supercharger (160) connected to a duct (115) which has foggers (250) located therein.

Claims 1-5, 8, 9, 11, 15-17, 19-21, 23-30, 33, 34, 36, 39-42, 44, 48 and 49 lack an inventive step under PCT Article 33(3) as being obvious over the FOSTER-PEGG article (hereafter FOSTER-PEGG)"Supercharging of Gas Turbines by Forced Draft Fans with Evaporative Intercooling".

FOSTER-PEGG discloses a retrofit supercharger for a gas turbine power plant having an evaporative cooler. It also discusses that it is common when designing a power plant to match the gas turbine power output to the required load needed to drive a generator (see page 4 column 2). FOSTER-PEGG also teaches that a supercharger and evaporative cooling can be used to compensate for any power losses that occur when the power plant is operated in high temperature (i.e. off design) conditions. FOSTER-PEGG does not disclose that a controller is used which limits the supercharger output so that power plant output does not exceed its maximum unsupercharged design output. Nor does FOSTER-PEGG disclose that the power is specifically controlled by regulating either the supercharger speed or the evaporative cooler. At the time of the invention it would have been obvious to control or limit the supercharging effect so that it does not result in a power plant output which is greater than the maximum unsupercharged design output. Firstly, the examiner notes that the skill level of one of ordinary skill in the gas turbine power plant art is high. Often requiring masters or doctoral degrees. (Continued on Supplemental Sheet.)

International application No.

PCT/US00/15821

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuati n of: Boxes I - VIII

Sheet 11

systems in order to control the power output of the gas turbine.

Claims 1-5, 8, 11-13, 15-17, 19-30, 32, 33, 34, 36-38, 40-42, 44, 48, 49, 60, 62-73 and 75 lack an inventive step under PCT Article 33(3) as being obvious over FOSTER-PEGG.

FOSTER-PEGG discloses a supercharger for a gas turbine power plant having an evaporative cooler. It is commonly understood that when designing a power plant the gas turbine power output must be matched to the required load needed to drive a generator. FOSTER-PEGG does not disclose that a controller is used which limits the supercharger output so that power plant output does not exceed its maximum unsupercharged design output. Nor does FOSTER-PEGG disclose that the power is specifically controlled by regulating either the supercharger speed or the evaporative cooler. At the time of the invention it would have been obvious to control or limit the supercharging effect so that it does not result in a power plant output which is greater than the maximum drive loads of the generator. Firstly, the examiner notes that the skill level of one of ordinary skill in the gas turbine power plant art is high. Often requiring masters or doctoral degrees. Secondly, as noted above when originally designing the power plant care must be taken to correctly match the gas turbine power output to the required load for the generator. Therefore, when retrofitting such a system it would have been obvious to a skilled artisan to note those design conditions as the already set forth maximums and to control the supercharging which is done at off design conditions so that these maximum power outputs are not exceeded. Thus resulting in a system which not only meets the power demands over a greater range of operating conditions but also prevents any damage to the driven devise. The examiner also gives official notice that it is well known to control supercharger pressure by controlling fan speed and to control evaporative cooling power increases by controlling the cooling system. Thus it would have been obvious to a skilled artisan to control either of these systems in order to control the power output of the gas turbine. It also would have been obvious to a skilled artisan to use plural of the supercharging fans in various arrangements in order to multiply the supercharging effect.

Claims 6, 7, 10, 18, 31, 35, 43, 50-59, 61 and 74 meet the criteria set out in PCT Article 33(2)-(4), because the prior art does not teach or fairly suggest a gas turbine power plant having a supercharged and a controller wherein the system comprises two or more superchargers pressurizing a plenum from which the gas turbine draws its airstream, the plenum having a bypass damper, or wherein there is a cooler and a secondary airstream is drawn from the gas turbine input airstream and passed back through the cooler to enhance cooling performance of the cooler. Further the prior art does not teach of a duct for conveying a high-pressure fluid, the duct comprising an interior conduit within an exterior conduit, the interior conduit having a polygonal cross-section and the exterior conduit having an arcuate cross-section, the conduits defining a space there between and the interior conduit having a flow passage in a wall thereof to provide fluid communication and equalize pressure between the interior of the interior conduit and the space.

	NEW	CITATIONS	***************************************
NONE			

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PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

Date of mailing (day/month/year)

From the INTERNATIONAL BUREAU

To:

DELUCA, Vincent, M.
Rothwell, Figg, Ernst & Manbeck
Suite 701 East
Columbia Square
555 13th Street N.W.
Washington, DC 20004
ETATS-UNIS D'AMERIQUE

22 November 2001 (22.11.01)			
Applicant's or agent's file reference 2297-111.PCT	IM	IPORTANT NOTIF	FICATION
	1.5	- 11 1 mal 6 m	
International application No.	1	ng date (day/month/ye	ar)
PCT/US00/15821	09 June ∠u	000 (09.06.00)	· · · · · · · · · · · · · · · · · · ·
The following indications appeared on record concerning: The applicant the inventor	the agent		n representative
Name and Address		of Nationality	State of Residence
ENHANCED TURBINE OUTPUT, LLC	[U	JS	US
3000 Connecticut Avenue, N.W. Washington, DC 20008 United States of America	Telepi	phone No.	
United States of America	Facsir	mile No.	
	Telep	orinter No.	
2. The International Bureau hereby notifies the applicant that t	he following change	e has been recorded c	concerning:
the person X the name the add		e nationality	the residence
Name and Address	State	of Nationality	State of Residence
ENHANCED TURBINE OUTPUT HOLDING,	U	IS	US
LLC 3000 Connecticut Avenue, N.W.	Telepi	hone No.	
Washington, DC 20008			
United States of America	Facsir	mile No.	
1 w	Telepr	orinter No.	
3. Further observations, if necessary:			
4. A copy of this notification has been sent to:			
X the receiving Office	the	e designated Offices o	concerned
the International Searching Authority	X the	e elected Offices conc	erned
the International Preliminary Examining Authority	oth	her:	
	Authorized officer		
The International Bureau of WIPO 34, chemin des Colombettes	1	Beate GIFFO-S	SCHMITT

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1211 Geneva 20, Switzerland

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT PCT WIPO

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 2297-111.PCT	FOR FURTHER ACTIO	Preliminary Examination Report (Form		
International application No.	International filing date (day/month/year) Priority date (day/month/year)			
PCT/US00/15821 09 JUNE 2000 10 JUNE 1999			10 JUNE 1999	
International Patent Classification (IPC) IPC(7): F02C 01/00, 09/00; E03B 7/1	or national classification and 0 and US Cl.: 60/39.03, 7	I IPC 28; 158/59		
Applicant WORK SMART ENERGY ENTERP	RISES, INC.			
 This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36. This REPORT consists of a total of				
		iteme	· · · · · · · · · · · · · · · · · · ·	
3. This report contains indications relating to the following items: I X Basis of the report II Priority III Non-establishment of report with regard to novelty, inventive step or industrial applicability IV Lack of unity of invention V X Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability, citations and explanations supporting such statement VI Certain documents cited VII Certain defects in the international application VIII Certain observations on the international application				
Date of submission of the demand Date of completion of this report				
03 JANUARY 2001 06 JULY 2001				
Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box POT Washington, D.C. 20231 Facsimile No. (703) 305-3230 Authorized officer CHARLES FREAY CHARLES FREAY Telephone No. (703) 308-0639				



International application No.

PCT/US00/15821

I. B	asis of the	report		
1. With	n regard to th	e elements of the intern	national application:*	
X	. •	tional application as		
x	the descri	• •		
	pages	1-42		, as originally filed
	pages	NICANTE		
	pages	NONE	, filed with the letter of	
X	the claims	40.00		
	pages		, as amended (together with	, as originally filed
	pages		•	, filed with the demand
	pages		, filed with the letter of	, med with the demand
X	the drawir			
	pages			, as originally filed
	pages			, filed with the demand
	pages	NONE	, filed with the letter of	
(T)	the season	as listing part of the	donnintion	
X	nages	ce listing part of the NONE	-	or originally filed
	pages	NONE	, filed with the letter of	, filed with the demand
	the langua	ge of publication of	urnished for the purposes of international se the international application (under Rule 48 mished for the purposes of international preliminal	3.3(b)).
	th regard to		or amino acid sequence disclosed in the internal dout on the basis of the sequence listing:	national application, the international
لسا	contained	in the international a	application in printed form.	
	filed toget	her with the internat	tional application in computer readable form	ı.
\Box	furnished s	subsequently to this	Authority in written form.	
$\overline{\sqcap}$	furnished s	subsequently to this	Authority in computer readable form.	•
	The statem	ent that the subseque	ntly furnished written sequence listing does no	ot go beyond the disclosure in the
		ent that the information	n recorded in computer readable form is identical	l to the writen sequence listing has
4. X			d in the cancellation of:	
	X the	description, pages	NONE	
	\square	claims, Nos.	NONE	
		irawings, sheets /fig	NONE	
5.	ı 	_	(some of) the amendments had not been made, sir	nce they have been considered to go
			indicated in the Supplemental Box (Rule 70.2(c)	•
in th	acement shee	ts which have been fur	nished to the receiving Office in response to an invi I are not annexed to this report since they do n	itation under Article 14 are referred to
	•	t_sheet_containing suc	h amendments must be referred to under item 1	and annexed to this report.

International application No.

NO

PCT/US00/15821

V.	Reasoned statement under Article 35(2) with regard to n velty, inventive step or industrial applicability; citations and explanations supp rting such statement				
1.	statement				
	Novelty (N)	Claims	(Please See supplemental sheet)	YES	

Claims

Inventive Step (IS)

Claims (Please See supplemental sheet)

YES

Claims (Please See supplemental sheet)

NO

(Please See supplemental sheet)

Industrial Applicability (IA)

Claims

(Please See supplemental sheet)

YES

(Please See supplemental sheet)

NO

2. citations and explanations (Rule 70.7)

Claims 77-80 lack novelty under PCT Article 33(2) as being anticipated by KOLP et al.

Kolp et al discloses a gas turbine power plant (see Fig. 12) having a gas turbine driving a generator and having first and second foggers located upstream of the gas turbine.

Claims 76, 77 and 79 are novelty under PCT Article 35(2) as being anticipated by Munk.

Munk discloses a gas turbine power plant (110, 120, 150) having a supercharger (160) connected to a duct (115) which has foggers (250) located therein.

Claims 1-5, 8, 9, 11, 15-17, 19-21, 23-30, 33, 34, 36, 39-42, 44, 48 and 49 lack an inventive step under PCT Article 35(3) as being obvious over the FOSTER-PEGG article (hereafter FOSTER-PEGG)"Supercharging of Gas Turbines by Forced Draft Fans with Evaporative Intercooling".

FOSTER-PEGG discloses a retrofit supercharger for a gas turbine power plant having an evaporative cooler. It also discusses that it is common when designing a power plant to match the gas turbine power output to the required load needed to drive a generator (see page 4 column 2). FOSTER-PEGG also teaches that a supercharger and evaporative cooling can be used to compensate for any power losses that occur when the power plant is operated in high temperature (i.e. off design) conditions. FOSTER-PEGG does not disclose that a controller is used which limits the supercharger output so that power plant output does not exceed its maximum unsupercharged design output. Nor does FOSTER-PEGG disclose that the power is specifically controlled by regulating either the supercharger speed or the evaporative cooler. At the time of the invention it would have been obvious to control or limit the supercharging effect so that it does not result in a power plant output which is greater than the maximum unsupercharged design output. Firstly, the examiner notes that the skill level of one of ordinary skill in the gas turbine power plant art is high. Often requiring masters or doctoral degrees. (Continued on Supplemental Sheet.)

International application No.

PCT/US00/15821

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 10

V. 1. REASONED STATEMENTS:

The report as to Novelty was positive (YES) with respect to claims 1-58, 60-75 and 81.

The report as to Novelty was negative (NO) with respect to claims 59 and 76-80.

The report as to Inventive Step was positive (YES) with respect to claims 6,7,10,18,31,35,43,50-59,61 and 74.

The report as to Inventive Step was negative (NO) with respect to claims 1-5,8,9,11-17,19-30,32-34,36-42,44-49,60,62-73 and 75-81.

The report as to Industrial Applicability was positive (YES) with respect to claims 1-81.

The report as to Industrial Applicability was negative (NO) with respect to claims NONE.

V. 2. REASONED STATEMENTS - CITATIONS AND EXPLANATIONS (Continued):

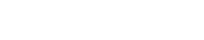
Secondly, it is noted that FOSTER-PEGG recognizes that when originally designing the power plant care must be taken to correctly match the gas turbine power output to the required load for the generator. Therefore, when retrofitting such a system it would have been obvious to a skilled artisan to note those design conditions as the already set forth maximums and to control the supercharging which is done at off design conditions so that these maximum power outputs are not exceeded. Thus resulting in a system which not only meets the power demands over a greater range of operating conditions but also prevents any damage to the driven devise. The examiner also gives official notice that it is well known to control supercharger pressure by controlling fan speed and to control evaporative cooling power increases by controlling the cooling system. Thus it would have been obvious to a skilled artisan to control either of these systems in order to control the power output of the gas turbine.

Claims 1-5, 8, 9, 11, 14-17, 19-30, 33, 34, 36, 40-42, 44, 48, 49 and 81 lack an inventive step under PCT Article 33(3) as being obvious over KOLP et al.

KOLP et al discloses a supercharger for a gas turbine power plant having an evaporative cooler. It is commonly understood that when designing a power plant the gas turbine power output must be matched to the required load needed to drive a generator. KOLP et al does not disclose that a controller is used which limits the supercharger output so that power plant output does not exceed its maximum unsupercharged design output. Nor does KOLP et al disclose that the power is specifically controlled by regulating either the supercharger speed or the evaporative cooler. At the time of the invention it would have been obvious to control or limit the supercharging effect so that it does not result in a power plant output which is greater than the maximum drive loads of the generator. Firstly, the examiner notes that the skill level of one of ordinary skill in the gas turbine power plant art is high. Often requiring masters or doctoral degrees. Secondly, as noted above when originally designing the power plant care must be taken to correctly match the gas turbine power output to the required load for the generator. Therefore, when retrofitting such a system it would have been obvious to a skilled artisan to note those design conditions as the already set forth maximums and to control the supercharging which is done at off design conditions so that these maximum power outputs are not exceeded. Thus resulting in a system which not only meets the power demands over a greater range of operating conditions but also prevents any damage to the driven devise. The examiner also gives official notice that it is well known to control supercharger pressure by controlling fan speed and to control evaporative cooling power increases by controlling the cooling system. Thus it would have been obvious to a skilled artisan to control either of these systems in order to control the power output of the gas turbine.

Claims 1-5, 8, 9, 11, 15-17, 19, 21-30, 33, 34, 36, 40-42, 44-47, 49 and 81 lack an inventive step under PCT Article 33(3) as being obvious over MUNK.

MUNK discloses a supercharger for a gas turbine power plant having an evaporative cooler. It is commonly understood that when designing a power plant the gas turbine power output must be matched to the required load needed to drive a generator. MUNK does not disclose that a controller is used which limits the supercharger output so that power plant output does not exceed its maximum unsupercharged design output. Nor does MUNK disclose that the power is specifically controlled by regulating either the supercharger speed or the evaporative cooler. At the time of the invention it would have been obvious to control or limit the supercharging effect so that it does not result in a power plant output which is greater than the maximum drive loads of the generator. Firstly, the examiner notes that the skill level of one of ordinary skill in the gas turbine power plant art is high. Often requiring masters or doctoral degrees. Secondly, as noted above when originally designing the power plant care must be taken to correctly match the gas turbine power output to the required load for the generator. Therefore, when retrofitting such a system it would have been obvious to a skilled artisan to note those design conditions as the already set forth maximums and to control the supercharging which is done at off design conditions so that these maximum power outputs are not exceeded. Thus resulting in a system which not only meets the power demands over a greater range of operating conditions but also prevents any damage to the driven devise. The examiner also gives official notice that it is well known to control supercharger pressure by controlling fan speed and to control evaporative cooling power increases by controlling the cooling system. Thus it would have been obvious to a skilled artisan to control either of these





International application No. PCT/US00/15821

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 11

systems in order to control the power output of the gas turbine.

Claims 1-5, 8, 11-13, 15-17, 19-30, 32, 33, 34, 36-38, 40-42, 44, 48, 49, 60, 62-73 and 75 lack an inventive step under PCT Article 33(3) as being obvious over FOSTER-PEGG.

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Claims 6, 7, 10, 18, 31, 35, 43, 50-59, 61 and 74 meet the criteria set out in PCT Article 33(2)-(4), because the prior art does not teach or fairly suggest a gas turbine power plant having a supercharged and a controller wherein the system comprises two or more superchargers pressurizing a plenum from which the gas turbine draws its airstream, the plenum having a bypass damper, or wherein there is a cooler and a secondary airstream is drawn from the gas turbine input airstream and passed back through the cooler to enhance cooling performance of the cooler. Further the prior art does not teach of a duct for conveying a high-pressure fluid, the duct comprising an interior conduit within an exterior conduit, the interior conduit having a polygonal cross-section and the exterior conduit having an arcuate cross-section, the conduits defining a space there between and the interior conduit having a flow passage in a wall thereof to provide fluid communication and equalize pressure between the interior of the interior conduit and the space.

	NEW	CITATIONS	
NONE			